Scleral Lens Induced Corneal Edema due to Poor Oxygen Transmissibility
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Cornea and Contact Lens Resident

Background

- 71 year old Native American male
- Medical History: *Diabetes Type II
  - Hypertension
  - Benign Prostate Hypertrophy
- Ocular History: Keratoconus OU
- Medications: Topiog, Mitomycin, Lensopril, Amlodipine, Finasteride
- Other information: No primary care physician for the past 1-2 years

Case Details

Initial Visit

Chief Complaint: Presented on 10/4/16 with lens discomfort and decreased vision OS. Started 4 days ago and has discontinued lens wear since.

Visual Acuities: *OD: 20/50 PH 20/40
**OS: CF PH 20/150

Contact Lens History: Jupiter scleral contact lens (Fit characteristics shown in Table 1)

Patient currently using Clear Care for cleaning and preserved Equate Saline to fill lenses.

Table 1: Initial lens fit characteristics

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Central Clearance</th>
<th>Limbal Clearance</th>
<th>Landing Zone</th>
<th>Central Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD 500 um</td>
<td>50 um 100 um inferior</td>
<td>Trace blanching</td>
<td>350 um</td>
<td></td>
</tr>
<tr>
<td>OD 200 um</td>
<td>50 um 100 um inferior</td>
<td>Trace blanching</td>
<td>350 um</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Initial lens fit characteristics

<table>
<thead>
<tr>
<th>Lens Thickness (µm)</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD 350 um</td>
<td>25.8</td>
<td>29.2</td>
<td>28.0</td>
<td>20.8</td>
<td>18.8</td>
<td>16.4</td>
<td>15.0</td>
</tr>
<tr>
<td>OD 300 um</td>
<td>25.8</td>
<td>29.2</td>
<td>28.0</td>
<td>20.8</td>
<td>18.8</td>
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</tr>
</tbody>
</table>

Table 2 Predicted Dk at the center thickness with OD and OS highlighted

Pertinent exam findings:

Cornea: OD Edema centrally over cone and peripherally with 2+ SPK
OS Edema centrally over cone and peripherally (greater than OD) 3+ SPK

Plan:

Discontinue preserved filling solution and replace with non-preserved 0.9% Sodium Chloride solution. Keep patient out of OS lens and remove OD lens as much as possible. Fix heavy artificial tear use.

Second Visit 10/6/2016

RE returns with lenses on to assess fit and recheck corneal findings.

Pertinent Exam findings

OD & OS SPK had improved slightly, patient still having large amount of microcystic edema with “whirly” edema.

Plan:

Refit scleral lens with less central thickness and central vault to allow for more oxygen to cornea throughout the day. Patient is to remove one lens two hours before sleeping and alternate between each eye every other night.

Findings

| Image 1 A-D picture RE cornea on 11/22/2016. Large amount of edema with 1-2+ SPK |

Diagnosis and Discussion

The final diagnosis was longstanding corneal edema due to hypoxia caused by a scleral contact lens.

A scleral contact lens is a medical device used to correct vision by masking corneal irregularity. With its rigid surface and large lacrimal lake, a scleral lens is intended to reduce glare and distortion. Unfortunately, as scleral contact fittings become more common, so do their ocular complications.

As Michaud et al describes, a major issue concerning the thickness of the scleral lens design and tear film involves a decreased amount of oxygen transmissibility. This concern is amplified as the target scleral lens population often have compromised corneas that require adequate oxygen.

As shown by Harvitt and Bonanno, an average cornea needs a central Dk of 35. Tables 2 and 4 can be used to calculate the approximate central Dk/t. For this particular patient, neither the initial lens nor the final lens met the HB criteria.

Additionally, the thickness of scleral lenses tends to decrease towards the mid periphery, especially for highly myopic designs. This also decreases the Dk/t at the limbal area, leading to the possibility of limbal stem cell deficiency.

In conclusion, even if optimally fitted, it is important to recognize when a particular contact lens is no longer healthy for a patient with corneal irregularity or ocular surface disease. If lack of oxygen transmissibility is suspected with a scleral contact lens, other designs such as corneal RGPs or hybrid contact lenses should be explored.

Treatment and Management

The need for more oxygen to the cornea led to the necessity for a refit of the scleral lens. This led to the instruction of the patient to remove one lens two hours before sleeping and alternate between the eyes each day. Artificial tear use was prescribed to assist with the heavy SPK. After a few months of questionable compliance, a better fitting lens, and no significant corneal improvement, the patient was refit in a hybrid contact lens.

References


Heart of America Contact Lens Society, 2017